

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

RECEIVED  
CENTRAL FAX CENTER  
OCT 24 2006

**Amendments to the Claims:**

This listing of claims will replace all prior versions and listings of claims in the application:

**Listing of Claims:**

1. (Amended) A method for increasing the degree of isomerization of a diesel product comprising:

(a) reacting a mixture of hydrogen and carbon monoxide at conversion promoting conditions to form a synthetic hydrocarbon stream, wherein the synthetic hydrocarbon stream comprises primarily C<sub>3+</sub> paraffins;

(b) hydrotreating the synthetic hydrocarbon stream under mild hydrotreating conditions;

(c)(b) forming a fractionator feedstream comprising the hydrotreated synthetic hydrocarbon stream;

(d)(e) separating the fractionator feedstream into at least three fractions including:

- (i) a light fraction;
- (ii) an intermediate fraction; and
- (iii) a heavy fraction;

wherein the light fraction has a boiling range with a 5% boiling point of about

300°F, wherein the intermediate fraction has a boiling range with a 5%

boiling point lower than that of the heavy fraction, and higher than that of the light fraction;

(ed) passing at least a portion of the heavy fraction to a first hydroconversion zone containing a hydrocracking catalyst;

(fe) reacting at least a portion of the heavy fraction from step (d) with hydrogen under

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

hydrocracking promoting conditions in the first hydroconversion zone to form a first hydroconverted effluent;

(~~gf~~) passing at least a portion of the first hydroconverted effluent to a second hydroconversion zone;

(~~hg~~) passing at least a portion of the intermediate fraction to the second hydroconversion zone; and

(~~ih~~) reacting at least a portion of the first hydroconverted effluent and at least a portion of the intermediate fraction with hydrogen in the second hydroconversion zone with a catalyst under conditions suitable to promote hydroisomerization, hydrocracking, dewaxing, or combinations thereof, to form a second hydroconverted effluent, wherein the portion of the intermediate fraction passed to the second hydroconversion zone and the portion of the first hydroconverted effluent passed to the second hydroconversion zone have lost their separate identities.

2. (Original) The method of claim 1 further comprising

(i) separating the second hydroconverted effluent produced in step (h) to create at least a middle distillate fraction therefrom.

3. (Original) The method of claim 2 further comprising forming a synthetic paraffinic fuel by blending

(1) at least a portion of the light fraction from step (b);

(2) at least a portion of the middle distillate fraction from step (i); and

(3) optionally, a portion of the intermediate fraction from step (b) not passed to

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

second hydroconversion zone.

4. (Original) The method of claim 2 wherein the fractionation of steps (c) and (i) are carried out in the same fractionator.

5. (Original) The method of claim 2 wherein the fractionation of steps (c) and (i) are carried out in different fractionators.

6. (Original) The method of claim 1 wherein the hydrocarbon synthesis in step (a) comprises a Fischer-Tropsch synthesis.

7. (Original) The method of claim 1 wherein the fractionator feedstream of step (b) further comprises hydrocarbons derived from refining of a crude oil, shale oil, or tar sand source.

8. (Amended) A method for increasing the degree of isomerization of a diesel product comprising:

(a) reacting a mixture of hydrogen and carbon monoxide at conversion promoting conditions to form a synthetic hydrocarbon stream, wherein the synthetic hydrocarbon stream comprises primarily C<sub>5+</sub> paraffins;

(b) forming a fractionator feedstream comprising the synthetic hydrocarbon stream;

(c) separating the fractionator feedstream into at least three fractions including:

(i) a light fraction;

(ii) an intermediate fraction; and

(iii) a heavy fraction;

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

wherein the light fraction has a boiling range with a 5% boiling point of about 300°F, wherein the intermediate fraction has a boiling range with a 5% boiling point lower than that of the heavy fraction, and higher than that of the light fraction;

- (d) passing at least a portion of the heavy fraction to a first hydroconversion zone containing a hydrocracking catalyst;
- (e) reacting at least a portion of the heavy fraction from step (d) with hydrogen under hydrocracking promoting conditions in the first hydroconversion zone to form a first hydroconverted effluent;
- (f) passing at least a portion of the first hydroconverted effluent to a second hydroconversion zone;
- (g) passing at least a portion of the intermediate fraction to the second hydroconversion zone; and
- (h) reacting at least a portion of the first hydroconverted effluent and at least a portion of the intermediate fraction with hydrogen in the second hydroconversion zone with a catalyst under conditions suitable to promote hydroisomerization, hydrocracking, dewaxing, or combinations thereof, to form a second hydroconverted effluent, wherein the portion of the intermediate fraction passed to the second hydroconversion zone and the portion of the first hydroconverted effluent passed to the second hydroconversion zone have lost their separate identities.

~~The method of claim 1~~ wherein the synthetic hydrocarbon stream is hydrotreated under “ultra-low severity” hydrotreating conditions before forming step (b).

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

9. (Canceled)
10. (Original) The method of claim 1 wherein the second hydroconversion zone is located downstream of the first hydrocracking zone.
11. (Original) The method of claim 10 wherein the second hydroconversion zone comprises a dewaxing catalyst.
12. (Original) The method of claim 1 wherein the second hydroconversion zone comprises hydroisomerization promoting conditions.
13. (Amended) A method for increasing the degree of isomerization of a diesel product comprising:
- (a) reacting a mixture of hydrogen and carbon monoxide at conversion promoting conditions to form a synthetic hydrocarbon stream, wherein the synthetic hydrocarbon stream comprises primarily C<sub>5+</sub> paraffins;
  - (b) forming a fractionator feedstream comprising the synthetic hydrocarbon stream;
  - (c) separating the fractionator feedstream into at least three fractions including:
    - (i) a light fraction;
    - (ii) an intermediate fraction; and
    - (iii) a heavy fraction;
- wherein the light fraction has a boiling range with a 5% boiling point of about 300°F, wherein the intermediate fraction has a boiling range with a 5% boiling point lower than that of the heavy fraction, and higher than that of

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

the light fraction:

- (d) passing at least a portion of the heavy fraction to a first hydroconversion zone containing a hydrocracking catalyst;
- (e) reacting at least a portion of the heavy fraction from step (d) with hydrogen under hydrocracking promoting conditions in the first hydroconversion zone to form a first hydroconverted effluent;
- (f) passing at least a portion of the first hydroconverted effluent to a second hydroconversion zone;
- (g) passing at least a portion of the intermediate fraction to the second hydroconversion zone; and
- (h) reacting at least a portion of the first hydroconverted effluent and at least a portion of the intermediate fraction with hydrogen in the second hydroconversion zone with a catalyst under conditions suitable to promote hydroisomerization, hydrocracking, dewaxing, or combinations thereof, to form a second hydroconverted effluent, wherein the portion of the intermediate fraction passed to the second hydroconversion zone and the portion of the first hydroconverted effluent passed to the second hydroconversion zone have lost their separate identities.

~~The method of claim 1~~ wherein at least one of the first and the second hydroconversion zones comprises a catalyst gradient, and further wherein the catalyst gradient has an acidity gradually decreasing along said hydroconversion zone.

14. (Original) The method of claim 1 wherein the catalysts in the first and second hydroconversion zones have the same hydrogenation component.

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

15. (Original) The method of claim 1 wherein the catalysts in the first and second hydroconversion zone comprise different hydrogenation components.
16. (Original) The method of claim 1 wherein the catalysts in the first and second hydroconversion zones comprise different cracking components.
17. (Original) The method of claim 1 wherein the catalyst in the second hydroconversion zone has a lower acidity than the catalyst in the first hydroconversion zone.
18. (Original) The method of claim 1 wherein the first and second hydroconversion zones are contained within a single vessel.
19. (Original) The method of claim 1 wherein the first and second hydroconversion zones are part of a continuous catalyst bed.
20. (Original) The method of claim 1 wherein the first and second hydroconversion zones are in separate vessels.
21. (Original) The method of claim 1 wherein the heavy fraction comprises a boiling range with a 5% point  $T_H$  equal to or greater than about 640°F.
22. (Original) The method of claim 21 wherein the intermediate fraction comprises a boiling range with a 5% boiling point  $T_I$  and a 95% boiling point  $T_J$ , wherein  $T_J$  is between about  $T_H$  -

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

100°F and  $T_H + 150^\circ\text{F}$ , and wherein  $T_I$  is between about 500°F and  $T_J - 50^\circ\text{F}$ .

23. (Original) The method of claim 21 wherein the light fraction comprises a boiling range with a 5% boiling point between about 330°F and about 350°F and a 95% boiling point  $T_k$ , wherein  $T_k$  is between about  $T_I - 50^\circ\text{F}$  and  $T_I + 50^\circ\text{F}$ , if  $T_I$  is less than 640°F, or  $T_k$  is about equal to about 640°F if  $T_I$  is greater than about 640°F.

24. (Original) The method of claim 1 wherein the heavy fraction comprises hydrocarbons with 20 or more carbon atoms.

25. (Original) The method of claim 24 wherein the intermediate fraction comprises hydrocarbons having between about 15 and about 20 carbon atoms.

26. (Original) The method of claim 1 wherein the heavy fraction comprises hydrocarbons with 'n' or more carbon atoms, and the intermediate fraction comprises hydrocarbons having more than about 15 carbon atoms, but less than about 'n' carbon atoms, wherein 'n' is greater than 20.

27. (Original) The method of claim 1 wherein the second hydroconversion zone has an inlet temperature equal to or greater than that of the first hydroconverted effluent.

28. (Amended) A method for increasing the degree of isomerization of a diesel product, derived from synthesis gas, comprising:

providing a hydrocarbon stream comprising  $C_{5+}$  paraffins, wherein a majority of said  $C_{5+}$



Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

paraffins are products of a hydrocarbon synthesis from synthesis gas wherein the products from the hydrocarbon synthesis have been first subjected to hydrotreating under mild hydrotreating conditions;

- (a) providing a first fraction comprising  $C_{20+}$  liquid hydrocarbons, wherein said first fraction has a 5% boiling point equal to or greater than about 640°F;
- (b) providing a second fraction comprising  $C_{15}-C_{20}$  liquid hydrocarbons,
- (c) wherein said second fraction has a 5% boiling point between about 400°F and about 550°F, and a 95% boiling point equal to or less than about 640°F, and
- (d) wherein the first and second fractions comprise primarily paraffins synthesized from synthesis gas;
- (e) reacting at least a portion of the first fraction in a first hydroconversion zone to generate a first hydroconverted hydrocarbon product stream;
- (f) reacting at least a portion of the second fraction in a second hydroconversion zone to generate a second hydroconverted hydrocarbon product stream;
- (g) wherein at least a portion of the first hydroconverted hydrocarbon product stream is optionally fed to the second hydroconversion zone.

29. (Original) The method according to claim 28 further comprising fractionating at least a portion of the second hydroconverted hydrocarbon product stream to produce at least a middle distillate with a 5% boiling point between about 330°F and about 350°F, and a 95% boiling point between about 500°F and about 600°F.

30. (Original) The method according to claim 29 further comprising providing a third fraction, wherein the third fraction has a 5% boiling point between about 330°F and about 350°F,

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

and a 95% boiling point between about 400°F and about 550°F and forming a synthetic paraffinic diesel by blending

- (1) at least a portion of the third fraction; and
- (2) at least a portion of the middle distillate.

31. (Original) The method according to claim 30 wherein the synthetic paraffinic diesel blend further comprises at least a portion of the first hydroconverted hydrocarbon product stream, wherein said fraction of the first hydroconverted hydrocarbon product has a 5% boiling point between about 330°F and about 350°F, and a 95% boiling point between about 500°F and about 600°F.

32. (Original) The method according to claim 30 wherein the synthetic paraffinic diesel blend further comprises at least a portion of the second fraction not passed to the second hydroconversion zone.

33. (Original) The method according to claim 31 wherein the synthetic paraffinic diesel blend further comprises at least a portion of the second fraction not passed to the second hydroconversion zone.

34. (Original) The method according to claim 30 wherein the first and second fractions are hydrotreated prior to reaction in their respective hydroconversion zone.

35. (Original) The method according to claim 30 further comprising passing at least a portion of said first hydroconverted hydrocarbon product stream to the second hydroconversion

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

zone;

36. (Original) The method of claim 35 wherein the second hydroconversion zone has an inlet temperature equal to or greater than that of the first hydroconverted hydrocarbon product stream.

37. (Amended) A method for increasing the production yield of a diesel product, wherein the diesel product comprises primarily products derived from a hydrocarbon synthesis, said method comprises:

- (a) providing a hydrocarbon stream comprising  $C_{5+}$  paraffins, wherein a majority of said  $C_{5+}$  paraffins are products of a hydrocarbon synthesis from synthesis gas wherein the products from the hydrocarbon synthesis have been first subjected to hydrotreating under mild hydrotreating conditions;
- (b) separating by fractionation said hydrocarbon stream into at least
  - (i) a wax fraction comprising a boiling range with a 5% boiling point  $T_H$ , wherein  $T_H$  is equal to or greater than about 640°F;
  - (ii) an intermediate fraction comprising a boiling range with a 5% boiling point  $T_I$  and a 95% boiling point  $T_J$ , wherein  $T_J$  is between about  $T_H-100^\circ\text{F}$  and  $T_H+150^\circ\text{F}$ , and wherein  $T_I$  is between about 500°F and  $T_J-50^\circ\text{F}$ ; and;
  - (iii) a middle distillate fraction comprising a boiling range with a 5% boiling point between about 330°F and about 350°F, and a 95% boiling point  $T_K$ , wherein  $T_K$  is between about  $T_I-50^\circ\text{F}$  and  $T_I+50^\circ\text{F}$ , if  $T_I$  is less than about 640°F, or  $T_K$  is equal to about 640°F if  $T_I$  is greater than 640°F;
- (c) passing at least a portion of the wax fraction in a first hydroconversion zone under hydrocracking promoting conditions to convert with hydrogen at least a portion of

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

the wax fraction to form a first hydroconverted effluent;

- (d) reacting in the presence of hydrogen the first hydroconverted effluent and at least a portion of intermediate fraction in a second hydroconversion reaction zone under suitable hydroconversion conditions to promote hydroisomerization, hydrocracking, dewaxing, or any combination thereof, to form a second hydroconverted effluent; and
- (e) feeding said second hydroconverted effluent to the fractionator of step (b),
- (f) forming a diesel product, wherein said diesel product comprises at least a portion of the resulting middle distillate fraction and optionally a portion of the intermediate fraction if  $T_J$  is less than about 640°F.

38. (Original) The method of claim 37 wherein  $T_H$  is about equal to about 640°F;  $T_J$  is about equal to about 640°F;  $T_I$  is between about 400°F and about 600°F; and  $T_K$  is equal to about  $T_I$ .

39. (Original) The method of claim 37 wherein  $T_H$  is about equal to about 640°F;  $T_J$  is between about 550°F and about 800°F;  $T_I$  is between about 400°F and about  $T_J$ -50°F; and  $T_K$  is equal to about  $T_I$ .

40. (Original) The method of claim 37 wherein  $T_H$  is equal to about 800°F;  $T_J$  is between about 700°F and about 850°F;  $T_I$  is between about 640°F and about  $T_J$ -50°F; and  $T_K$  is equal to about 640°F.

41. (Original) The method of claim 37 wherein  $T_H$  is about equal to about 900°F;  $T_J$  is between about 700°F and about 900°F;  $T_I$  is between about 640°F and about  $T_J$ -50°F; and  $T_K$  is

Appl. No. 10/802,974  
Amendment Dated October 24, 2006  
Reply to Office Action of June 27, 2006

equal to about 640°F.

42. (Original) The method of claim 37 further comprising passing the hydrocarbon stream in a hydrotreater under hydrotreating promoting conditions before step (b).